EMBRYOLOGY.[1]

Experimental Embryology.—Two interesting pieces of work employing experimental methods have been recently published by Dr. T. H. Morgan. The first[2] appears to be but a preliminary account to be followed by more detailed illustration. The second[3] is complete and illustrated by figures drawn by the associated author Umé-Tsuda.

The former deals with the echinoderm—the latter with the frog-egg.

In the sea-urchin *Arbacia punctulata* minute fragments of the eggs may be fertilized and undergo cleavage, but there is no evidence that fragments develop unless they have part of the female pronucleus. Hence Boveri's experiments[4] upon the cleavage of e-nucleated fragments are to be regarded with doubt.

When the eggs are pressed, after the method of Driesch, there is evidence that the place of formation of the micromeres is pre-determined, and not localized by intersection of the actual first and second planes of cleavage since it may be where the first and third furrows cross.

A repetition of Loeb's experiments[5] shows that the action of an increased strength of sodium-chlorid in the sea water is to stop not only the external but also the internal or nuclear phenomena of cleavage, contrary to Loeb's notion.

In the starfish *Asterias forbesii* it seems that shaking the eggs hastens the maturity processes!

The most remarkable part of the paper is the evidence pointing strongly to the conclusion that the eggs of the above star-fish may be fertilized by the sperm of the above sea-urchin, "two animals belonging to entirely different 'Classes' of the animal kingdom"!

In the second paper the vexed questions of the orientation of the embryo, the place and manner of closure of the blastopore and the related idea of concrescence are approached not only from direct study of living eggs but from the examination by sections and surface views of eggs that have been injured by needle-thrusts or modified, retarded, in development by action of certain salt solutions. Many important details hitherto overlooked are made plain and some interest-

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[2] Anatomische Anzeiger IX.

[3] Quart. Journal Mic. Sci., Jan., 1894.

[4] See American Naturalist, March, 1893.

[5] See American Naturalist, April, 1893.

ing, but unsuccessful, experiments recorded in addition to these of immediate value. The general result is that the blastopore begins to form below the equator of the egg, in the white region, and closes in by a peculiar overgrowth from the dorsal lip, so that we cannot speak of a real process of concrescence of two lateral areas. The embryo is, however, formed along this region, that is upon what was the lower white side of the egg.

Embryology of Cyclascornea.—Heinrich Stauffacher has recently (Jen. Zeit., II Heft, 1893, pp. 196–246) studied in considerable detail the development and segmentation of the ova in *Cyclas cornea* L., in which the ova are developed in a single pair of follicles, the sperm in several pairs. The follicle is a simple tube lined with columar epitbelium, surrounded by a homogeneous membrane. The primitive ova first appear as small spherical or elliptical cells next the membrane, among the bases of the cells of the follicle. The nucleus occupies almost the whole cell and has its chromatin rather uniformly distributed in the form of granules. As the ovum grows, it projects into the cavity of the follicle beyond the surrounding cells, but remains attached to the membrane by a constantly narrowing stalk. The egg membrane is formed only over the free projecting portion; the point of the ovum by which it is last attached by the stalk, persists as the micropyle. The ovum grows in part by the absorption of the surrounding cells of the follicle. Two Centrosomes were found in the mature ovum.

Stauffacher's description of the earliest stages of segmentation does not differ widely from Ziegler's account (Zeit. Wiss. Zoöl., Vol. 41). The egg divides into a small primary micromere and a large macromere. The former divides into right and left secondary micromeres, the latter into a second primary micromere and a macromere. This process is repeated, new primary micromeres being formed from the same side of the macromere, so that in these early stages, the secondary micromeres are arranged as right and left rows lying on the macromere.

Bilateral symmetry is shown from the first. During the resting period after the formation of the first primary micromere, the protoplasm of the micromere with its nucleus, becomes arranged around its free periphery, leaving a considerable cavity in the micromere next the macromere. As the second, third and fourth primary micromeres are formed, a cavity is similarly found in each. It disappears from each as the next primary micromere is formed, and is not present after the fourth.

The true cleavage cavity appears in the 13-cell stage. In the 16-cell stage two mesenchyme cells were found lying in the cleavage cavity, near the macromere, and Stauffacher thinks they are derived from it.

At about the 30-cell stage the last primary micromere is formed. Ziegler thought it formed the two large primary mesoderm cells, but Stauffacher thinks it enters into the formation of the ectoderm along with all the previously formed micromeres.

The macromere next divides into equal right and left halves. From each of these a large cell is segmented off into the cleavage cavity, one slightly before the other, agreeing with Rabl's account for Unio. These two cells last formed are the primary mesoderm cells. The two small remaining macromeres form the endoderm.—C. P. SIGERFOOS.